Claims

1. A system for detecting an acoustic signal relating to a target object, including:

an array of detectors, each detector in the array configured to receive a signal from a corresponding region of the target object and to generate an output representing the received signal;

a plurality of filters, each filter configured to receive the output from one of the detectors and to generate from the received output at least one filtered signal relating to a vibration of the corresponding region of the target object; and

a processing module configured to generate from each of the filtered signals a processed output representing an acoustic signal relating to the corresponding region.

2. The system of claim 1, wherein the acoustic signal relates to an oscillation of the target object.

3. The system of claim 1, wherein the acoustic signal relates to a transient pulse of the target object.

4. The system of claim 1, wherein at least a portion of the received signals include electromagnetic radiation reflected from the corresponding regions of the target object.

5. The system of claim 4, wherein the reflected radiation includes visible radiation.

6. The system of claim 4, wherein the reflected radiation includes infrared radiation.

7. The system of claim 4, wherein the reflected radiation includes ultraviolet radiation.

8 The system of claim 1, wherein at least a portion of the received signals include electromagnetic radiation emitted from the corresponding regions of the target object.

9. The system of claim 8, wherein the emitted radiation includes thermal IR radiation.

10. The system of claim 8, wherein the emitted radiation includes fluorescent radiation.

11. The system of claim 1, wherein the filters are configured to AC couple the outputs to generate filtered signals from which DC components have been at least partly removed.

12. The system of claim 1, wherein the processing module is configured to generate frequency information for each of the filtered signals.

13. The system of claim 12, wherein the processing module is configured to generate, for each filtered signal, a contrast signal representing a contrast attribute of the corresponding filtered signal.

14. The system of claim 13, wherein the processing module is configured to correlate the contrast attributes with the frequency information.

15. The system of claim 14, wherein the processing module is configured to generate an output representing a plot of contrast distribution across the array of detectors, the contrast distribution being associated with a given frequency.

16. The system of claim 1, wherein the detectors are configured to sample received signals at a predetermined rate.

17. The system of claim 15, wherein the predetermined rate is fixed.

18. The system of claim 15, wherein the predetermined rate is variable.

19. The system of claim 15, wherein the processing module is configured to generate the processed outputs at predetermined regular time intervals, the time intervals being of a length that is greater than a time interval corresponding to the predetermined sampling rate.

20. The system of claim 4, wherein at least a portion of the reflected signals are due to naturally occurring ambient electromagnetic radiation.

21. The system of claim 4, wherein at least a portion of the reflected signals are due to artificially generated electromagnetic radiation directed at the target object.

22. The system of claim 4, wherein the reflected electromagnetic radiation is at least in part from a collimated radiation source.

23. The system of claim 4, wherein the reflected electromagnetic radiation is at least in part from a coherent radiation source.

24. The system of claim 1, further including an apparatus configured to induce vibrations in the target object.

25. The system of claim 1, wherein the detectors comprise photodiodes.

26. The system of claim 1, wherein the detectors comprise CMOS detectors.

27. The system of claim 1, including an optical filter positioned between the array of the detectors and the target object.

28. The system of claim 1, wherein the processing module is configured to generate a contrast signal corresponding to the vibration of each corresponding region.

29. The system of claim 28, further including a visual output device coupled to the processing module and configured to generate a representation of the target object superimposed with the contrast signals correlated with their respective corresponding regions.

30. The system of claim 1, wherein the processing module is configured to generate a temporal spectral signal corresponding to the vibration of each corresponding region.

31. The system of claim 28, further including a visual output device coupled to the processing module and configured to generate a representation of the target object superimposed with the spectral signals correlated with their respective corresponding regions.

34. A method for detecting acoustic signals relating to a target object, including the steps of:

receiving an acoustic signal from each of a plurality of regions of the target object at a corresponding plurality of detectors;

generating from each received signal a signal that is correlated to a vibration of the corresponding region;

digitizing each correlated signal;

generating from the digitized signals an output representing the vibrations of the regions of the target object.

35. The method of claim 34, further including the step of executing a Fourier transform on the digitized signals.

36. The method of claim 34, wherein the plurality of detectors are arranged in a rectangular array.

37. The method of claim 34, wherein the acoustic signals include modulated light reflected from the target object.

38. The method of claim 37, wherein the reflected light includes light having a frequency in at least one frequency range of visible, infrared and ultraviolet radiation.

39. The method of claim 34, wherein the acoustic signals include modulated light emitted from the target object.

40. The method of claim 39, wherein the emitted light includes thermal infrared radiation.

41. The method of claim 39, wherein the emitted light includes fluorescent radiation.

42. The method of claim 34, further including the step of optically filtering the signals received from the plurality of regions.

43. The method of claim 34, further including the step of generating contrast signals from the received signals relating to the vibrations of the corresponding regions.

44. The method of claim 34, further including the step of displaying a representation of the target object visually correlated with the generated signals representing the vibrations of the corresponding regions.

45. The method of claim 34, wherein the generating step includes the step of generating a temporal spectral signal corresponding to the vibration of each corresponding region.

46. The method of claim 34, further including the step of extracting from the received signals a representation of an oscillation of the corresponding regions.

47. The method of claim 47, wherein the extracting step includes the step of AC-coupling the received signals.

48. The method of claim 47, wherein the extracting step includes the step of removing from the received signals at least one component representing ambient radiation in a vicinity of the target object.

49. A system for acoustically imaging a target object undergoing vibration, including:

an array of photodetectors;

a lens positioned to focus light signals received from individual regions of the target object onto the photodetectors, the light signals being modulated in a manner corresponding to vibrations of the individual regions;

a circuit coupled to each photodetector configured to isolate vibration signals from the light signals;

digitizing logic configured to digitize the vibration signals;

transform logic configured to extract frequency information from the digitized vibration signals; and

imaging logic configured to correlate the extracted frequency information with the corresponding regions of the target object, the correlated frequency information representing an acoustic image of the target region.